

## **Repair instructions**

**UNIVERSAL 32  
UNIVERSAL 32 R**

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## 1. Introduction

- This repair instruction is only intended for specialized staff authorized by HETTICH.



Interventions and modifications at centrifuges, which have been conducted by persons not authorized by HETTICH, are at their own risk and entail the loss of all guarantee and liability claims. In such an event any guarantee claim or liability claim against the HETTICH expires.

- The aim of these repair instructions is to enable any errors to be located and eliminated quickly.



There should be no interventions at, or replacement of components on the individual electronics boards. Experience shows that if an intervention is not performed in accordance with regulations, or if a component is installed whose specification is not identical to that of the original component, then the error (defect) which has occurred will be compounded by further damage. In such an event any guarantee claim or liability claim against the HETTICH ceases to exist.

Any electronics boards which are not repaired in accordance with the regulations cannot be acknowledged as being replacement spare parts.

- Information about the operation of the centrifuge please see operating instructions.
- We reserve all rights for these technical documents.
- Technical alterations reserved.

## 2. Description of the UNIVERSAL 32 / 32 R

### 2.1. Functional structure of the UNIVERSAL 32 / 32 R

These microprocessor-controlled centrifuges are comprised of the following electrical components:

- Control panel (CP), microprocessor-controlled
- Supply board (SB)
- Frequency converter (FC, motor control), microprocessor-controlled
- Motor with speed sensor (speedometer)
- Braking chopper (BC) with brake resistor (BR)
- Lid locking (LL)
- Cooling board (CB), only UNIVERSAL 32 R

### 2.2. Control panel (CP)

The CP is the "brain" or "master" of the centrifuge.

Via a serial data bus system, the MASTER controls its SLAVE, the component:

- frequency converter (FC)

The individual tasks of the CP are:

- Management of operator inputs and control of LCD display.
- Storage of 3 run programs.
- Control of components:
- FC via the enabling circuit and via the serial interface.
- cooling and fan.
- Evaluation of the speed sensor (speedometer).
- Evaluation of the imbalance switch.
- Evaluation of the FC fault alarm circuit.
- Evaluation of the LL open/closed signalling circuit.
- Control of the relay for the LL solenoid at rotor standstill
- Temperature measurement and sensor evaluation of the temperature sensor in centrifuge chamber (only refrigerated centrifuge).
- Routine for input, storage and transfer of temperature offset values.
- Format of the serial interface:
  - 5 Volt interface with 3 conductors.
  - (16-pole control cable, pole 6, 8 and 11).
- The CP is powered from the SB via the control cable:

+ 10...15 Volt	pole 1,2
GND	pole 15,16

### 2.3. Supply board (SB)

The SB performs the following individual functions:

- 12 V DC and 5 V DC supply for the SB.
- 12 V DC supply for the CP.
- 12 V DC supply for the CB (only UNIVERSAL 32 R).
- Plugging station X5 for mains power supply, LL magnet and transmission of the signalling circuit for LL-switch (open/closed over opto-coupler to the CP).
- Power supply for speed sensor (speedometer).
- Plugging station X4 for speed sensor cable and transmission to the CP and FC.
- Control of the relay for the LL solenoid at rotor standstill
- Plugging station X3 for the imbalance switch and direct transmission of the imbalance signal to the CP.
- The 5 Volt interface with 3 conductors is converted to an RS 485 interface with 2 conductors:
  - Interface to FC: RS 485-interface via 2 conductors.
  - Transfer of primary enabling (=Hardware STOP) CP ⇒ FC
  - Transfer of fault circuit (FC-ERROR) FC ⇒ CP

### 2.4. Frequency converter (FC)

The FC performs the following individual functions:

- Generation of the motor power supply.  
(3-phase AC current of variable frequency and voltage)  
Mode of operation: The mains supply is rectified, smoothed and chopped in three bridge elements to give a pulse-duration modulated supply.
- Monitoring of the motor current.
- Evaluation of the overtemperature switch in the motor (only version 115V, AC).
- Slave behaviour (handling of interrogations and commands from the CP via the serial interface):
  - RS 485-interface with 2 conductors  
(10-pole control cable, pole 3 and 5).
- Evaluation of the primary enabling (Hardware STOP) for the FC  
(10-pole control cable, pole 7).
- Evaluation of potential faults and monitoring of the fault circuit (FC-ERROR)  
(10-pole control cable, pole 4).
- The electrical power, which resulted from braking, will be conducted to the BR. The braking chopper switches at a voltage:
  - from approximately 390V (230V series).
  - from approximately 200V (115V series).
- The BR is protected by an overtemperature fuse. At a short circuit on the BC, which is located on the FC, the BR overheats because of high current. The overtemperature fuse cuts off the voltage supply from the FC.

- The CP issues the following via the serial interface:
  - Speed
  - Starting and braking levels
  - Control commands START, BRAKE, STOP
- State display by LED's:

In standby mode	the green LED is on
In running mode	the green LED is on
In fault mode	the green LED flashes

If the FC processor detects a fault, it shuts down itself automatically and triggers the fault circuit (FC-ERROR). The CP then interrogates the type of fault via the serial interface.

## 2.5. Special features

- Multiprocessor concept:

Although one microprocessor will fail, the other one will continue to monitor its assigned area.

If the CP fails, the drive will be shut down automatically by the FC when no interrogations have been received via the interface for more than 30 seconds.
- Interface concept:

Transmission of data is monitored by an extra check sum.
- Hardware concept:

All switches with a safety relevant function are of the NC-contact type, which means that loose contacts and open-circuit faults can also be detected.

## 2.6. Motor / Tacho system

- The motor is a 3 phase asynchronous motor with 2 pairs of poles.
- A speed sensor (speedometer) attached to the motor receives the following from the transmitter attached to the rotor,
  - rotor code information (see section 9) and
  - speed data (6 pulses per revolution)
- The ACTUAL speed is monitored and controlled via the CP
  - Double safety: The FC is also programmed that no value of speed in excess of the maximum permitted rotor speed can be selected. The FC monitors the speed and switches off at excess speed with error code "ERROR 84".
- Rotor standstill is monitored via the CP.
  - The lid can only be opened when the CP has detected standstill.

## 2.7. Imbalance switch

- A switch detects any imbalance.
- Imbalance can only be detected in running mode (starting, centrifuging and braking).
- If any imbalance is detected, the drive is changed over to braking.

## 2.8. Interlocking

- Opening of the LL is prevented by a latch. The LL can only be opened when the relay on the SB is energized by the CP. This occurs when the rotor is at standstill and mains power is applied. A solenoid is energized and releases the latch.
- The centrifuge can only be started when the lid is closed. A microswitch on the LL detects the position of the LL.

## 2.9. Cooling

- **Temperature behaviour:**
  - When rotor is at standstill and the lid is locked, the cooling is operating.
  - When rotor is at standstill and the lid is unlocked, there is no cooling.

### 2.9.1. Temperature sensor B1, in the centrifuge chamber

- This temperature is processed in the CP.
- The housing of the temperature sensor B1 also contains an overtemperature switch. In refrigerated centrifuges this switch cuts off the drive at  $> 60^{\circ}\text{C}$ .

### 2.9.2. Function of the cooling board (CB) A3

- Plugging station (X3) for the temperature sensor and the overtemperature switch in the centrifuge chamber.
- The voltage of the temperature sensor in the centrifuge chamber plug X4 being transmitted over a 10-pole CC to the CP plug X101.
- The signal of the overtemperature switch in the centrifuge chamber plug X4 being onward transmitted over a 10-pole CC to the CP plug X101.
- Plugging station (X2) for the overheating protection B2 at the condenser.
- Relay circuit for the compressor and the fan. The overheating protection B2 at the condenser is series connected to the relay voltage.
- Plugging station (X1) for the compressor and the fan.

## 2.10. Fan

- The fans cool down the refrigerant flowing through the condenser.
- The fan is parallel-connected to the compressor.



## 2.11. Offset calibration

- Offset calibration is performed in order to equalize the tolerances of the temperature sensor and the electronics.

Perform Offset calibration when replacing:	Where/How
– the temperature sensor	calibrate the temperature sensor.
– the CP	calibrate temperature sensor and read out the old offset values and put them in the new CP.
– the CP-EPROM	Read out the old offset values and put them in the new CP.

## 2.12. Protection

Mains power input	⇒	Mains input with overvoltage protection
Mains switch	⇒	Thermal overload protection (fuse)
FC	⇒	Electronic protection
Motor	⇒	Overtemperature cutout > 135°C (only 115 V version).
Cooling	⇒	Overtemperature switch in centrifuge chamber and at condenser.

### **3. Requirements for error identification**

#### **3.1. Correct power supply**

- All fuses of house installation are intact.

Mains voltage is present on the following circuits:

- Cable leading to mains cable
- Appliance plug
- Mains switch
- Radio interference suppression filter
- Supply board (SB) A1, plug X5, pin 1 and pin 5

#### **3.2. Functional check**

- Mains switch is ON.
- All LED`s on control panel must light up.
- The centrifuge type and the software version number appears in the display.
- After about 8 sec. the display switches over to
  - the most recently used centrifuging data or
  - the error code.

#### **3.3. Procedure for diagnosing errors**

- Look for the displayed error code in the chapter 4 "Error messages".
- Remedy the error according to the instructions.
- Carry out a functional check after every repair and whenever a component is replaced.
- The technical data which were determined during the final check can be found in the chapter 7 "Functional check".

## 4. Error messages

### 4.1. Brief description

- Error messages in: UNIVERSAL 32  
UNIVERSAL 32 R

Error designation	No.	Brief description	Page
TACHO-ERROR	01	Speedometer pulses break down during rotation	13
TACHO-ERROR	02	No speedometer pulses after start command	13
IMBALANCE		Imbalance on motor axle	14
CONTROL-ERROR	04	LL error, lid opened without recognizing that motor had stopped	14
N > MAX	05	Excessive speed error, 250 RPM above n-max of rotor	14
ROTORCODE	10	Invalid rotor code	16
MAINS INTERRUPT		Mains interruption	16
VERSION-ERROR	12	Error in initialization	16
N < MIN	13	Speed error, slippage is too great	17
CONTROL-ERROR	21	CP - error: speed	17
CONTROL-ERROR	22	CP - error: I <sup>2</sup> C bus	16
CONTROL-ERROR	23	CP - error: display memory	16
CONTROL-ERROR	24	CP - error: clock timeout	16
CONTROL-ERROR	25	CP - error: EEPROM	16
CONTROL-ERROR	26	CP - error: driver defective	16
N > ROTOR-MAX	---	CP - error: nominal speed is higher than permitted rotor speed or nominal RCF is higher than permitted rotor RCF	16
SER I/O-ERROR	30	No connection between CP and serial interface	17
SER I/O-ERROR	31	No connection between FC and serial interface	17
SER I/O-ERROR	33	Subassembly data incorrectly transmitted	17
SER I/O-ERROR	34	Data incorrectly transmitted between CP and FC	17
SER I/O-ERROR	36	No acknowledgement (NAK) from FC to CP	17
No cooling		Overtemperature at condenser	18
(No error displayed)			
°C / *-ERROR	52	Overtemperature in centrifuge chamber	18
°C / *-ERROR	53	Temperature sensor in centrifuge chamber is defective	18

Error designation	No.	Brief description	Page
FU/CCI-ERROR	60	Faulty release signal to FC	19
FU/CCI-ERROR	61	FC - error: computing section	19
FU/CCI-ERROR	62	FC - error: undervoltage	19
FU/CCI-ERROR	63	FC - error: overcurrent	20
FU/CCI-ERROR	64	FC - error: overvoltage	20
FU/CCI-ERROR	67	FC - error: overtemperature in motor (only 115V)	20
FU/CCI-ERROR	68	FC - error: overtemperature in FC	20
FU/CCI-ERROR	69	FC - error: EEPROM	21
FU/CCI-ERROR	84	FC - error: FC recognizes excess speed	21
FU/CCI-ERROR	85	FC - error: "Watchdog" in FC had triggered	21

## 4.2. Description and elimination of errors

### TACHO - ERROR 01

Error cause	During centrifugation the speedometer pulses are interrupted.
Error consequence	The rotor slows down until it stops. After the rotor stops, there is a DC braking for 30 sec. An MR during slowing-down causes a DC braking for 3 min. After the DC braking, the "open the lid" release takes place. Further cooling to NOMINAL temperature.
Error remedy	<ul style="list-style-type: none"> <li>• Speed sensor (speedometer) defective or loose contact on plug. Measure speedometer pulses on plug X4 / SB (pin 4 - pin 2).</li> <li>• CC to CP, or CC to FC is defective.</li> <li>• SB or CP or FC is defective.</li> </ul>
Measurement	Also see at SB-X4 and CP-X1 (PIN 14) and FC S501 (PIN 8)
Error code reset	Open the lid. Turn the rotor by hand and perform an MR while the rotor is turning.

### TACHO - ERROR 02

Error cause	There are no speedometer pulses on the CP after start-up.
Error consequence	The rotor slows down until it stops. After the rotor stops, there is a DC braking for 30 sec. An MR during slowing-down causes a DC braking for 3 min. After the DC braking, the "open the lid" release takes place. Further cooling to NOMINAL temperature.
Error remedy	<ul style="list-style-type: none"> <li>• Start-up took place without the rotor.</li> <li>• Motor not connected.</li> <li>• Motor is defective.</li> <li>• Speed sensor (speedometer) defective, or loose contact on plug. Measure speedometer pulses on plug X4 / SB (pin 4 - pin 2).</li> <li>• CC to CP, or CC to FC is defective.</li> <li>• No release signal to FC.</li> <li>• SB or CP or FC is defective.</li> </ul>
Measurement	Also see at SB-X4 and CP-X1 (PIN 14) and FC S501 (PIN 8)
Error code reset	Open the lid. Turn the rotor by hand and perform an MR while the rotor is turning.

## IMBALANCE

Error cause	Imbalance on motor axle.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached.
Error remedy	<ul style="list-style-type: none"> <li>• Weight difference in rotor components.</li> <li>• Supporting lugs not lubricated.</li> <li>• False IMBALANCE MODE is set (see chapter "Imbalance Mode").</li> <li>• Imbalance switch not connected.</li> <li>• Imbalance switch is defective.</li> <li>• Loose contact in cable or plug.</li> <li>• CC to CP is defective.</li> <li>• CP or SB is defective.</li> </ul>
Measurement	Also see at SB-X3 and CP-X1 (PIN 12)
Error code reset	Perform an MR.

## CONTROL - ERROR 04

Error cause	LL is open during centrifugation.
Error consequence	Slowing down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached.
Error remedy	<ul style="list-style-type: none"> <li>• LL is defective and can be opened during centrifugation.</li> <li>• Loose contact in cable or in plug.</li> <li>• CC to CP is defective.</li> <li>• CP or SB is defective.</li> </ul>
Measurement	Also see at SB-X5 (PIN 2 and PIN 6) and CP-X1 (PIN 5)
Error code reset	Perform an MR.

## N > MAX 05

Error cause	Excess speed. The speed recognised by the speed sensor (speedometer) is 250 RPM greater than the n-max speed of the rotor.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached.
Error remedy	<ul style="list-style-type: none"> <li>• Insulation of speed sensor (speedometer) cable is defective.</li> <li>• Loose contact on speed sensor (speedometer) cable.</li> <li>• Speed sensor (speedometer) is defective.</li> <li>• CC to CP is defective.</li> <li>• CP or FC or SB is defective.</li> </ul>
Error code reset	Perform an MR.

## ROTORCODE 10

Error cause	An invalid rotor code was read during start-up.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached.
Error remedy	<ul style="list-style-type: none"><li>• Magnetic coding on rotor is defective.</li><li>• Speedometer system is defective.</li><li>• Loose contact on speed sensor (speedometer) plug</li><li>• The rotation of the rotor (direction) is incorrect.</li></ul>
Measurement	Also see section 10.
Error code reset	Open the lid or perform an MR.

## MAINS INTERRUPT

Error cause	Interruption of mains supply during centrifugation.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. <ul style="list-style-type: none"><li>– Switching on at the mains during centrifugation causes slowing-down until the "open the lid" release occurs.</li><li>– Switching on at the mains when the rotor has stopped brings about the "open the lid" release.</li></ul>
Error remedy	<ul style="list-style-type: none"><li>• Power supply has failed.</li><li>• Loose contact in electrical connections.</li><li>• CC to CP is defective.</li></ul>
Error code reset	Open the lid and press the <b>START</b> key.



This error **cannot** be reset by an MR

## VERSION - ERROR 12

Error cause	Differences in the initialisation from CP (EPROM) or FC.
Error consequence	No further user operation is possible.
Error remedy	<ul style="list-style-type: none"><li>• An incorrect EPROM has been plugged into CP.</li></ul>
Measurement	Also see initialisation section 5.2
Error code reset	Perform an MR.

**N < MIN 13**

Error cause	Insufficient speed; the slippage of the motor is too great. The centrifuge regulation can adjust the speed by 5% max (the limit of adjustment). The error is indicated if the ACTUAL speed is lower than the NOMINAL speed minus 5%.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached
Error remedy	<ul style="list-style-type: none"> <li>• Motor is labouring (damage to bearings).</li> <li>• Motor has a short-circuited coil (coil is defective).</li> <li>• Loose contact in the electrical connections.</li> <li>• FC is defective.</li> <li>• Release signal to FC was interrupted during centrifugation.</li> </ul>
Error code reset	Open the LL. Perform an MR.

**CONTROL - ERROR 21 - 26**

Error cause	Internal error in CP.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Error remedy	<ul style="list-style-type: none"> <li>• CP is defective.</li> </ul>
Error code reset	Perform an MR.

**N > ROTOR-MAX**

Error cause	Error in the entered program
Error consequence	Further operation is not possible.
Error remedy	SET speed or SET RCF is higher than the permissible rotor speed or permissible rotor RCF.
Error code reset	Carry out a MAINS RESET or open the lid. Reduce the speed or RCF in the entered program to the permissible rotor speed or permissible rotor RCF.



**SER I/O - ERROR 30 and ERROR 31**

Error cause	CP has no connection to the component FC via serial interface.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Error remedy	<ul style="list-style-type: none"><li>• CC to FC is defective.</li><li>• There is no voltage on FC.</li><li>• F2 overtemperature fuse on brake resistor has blown or is not connected.</li><li>• CP or FC is defective.</li><li>• Cable on plug S102 is not or wrong plugged</li></ul>
Error code reset	Perform an MR.

**SER I/O - ERROR 33**

Error cause	CP is not receiving correct data from FC.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Error remedy	<ul style="list-style-type: none"><li>• CC to FC is defective.</li><li>• CP or FC is defective.</li></ul>
Error code reset	Perform an MR.

**SER I/O - ERROR 34**

Error cause	CP is not receiving correct data from FC.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached.
Error remedy	<ul style="list-style-type: none"><li>• CC to FC is defective.</li><li>• CP or FC is defective.</li></ul>
Error code reset	Perform an MR.

**SER I/O - ERROR 36**

Error cause	FC sends signal NAK to the CP after receiving an unknown command. NAK (not acknowledged).
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Further cooling until NOMINAL temperature is reached.
Error remedy	<ul style="list-style-type: none"><li>• CC to FC is defective.</li><li>• FC is defective.</li><li>• CP is defective.</li></ul>
Error code reset	Perform an MR.

**NO COOLING**

Error cause	No cooling in centrifuge chamber. Overtemperature at condenser, temperature > 60°C.
Error consequence	Cooling switches off. Continuance of centrifugation until temperature switch in the centrifuge chamber triggers and "ERROR 52" appears. The centrifuge slows down until the "open the lid" release occurs.
Error remedy	<ul style="list-style-type: none"> <li>• Condenser soiled.</li> <li>• Loose contact in plug.</li> <li>• SB is defective.</li> <li>• Fan is defective.</li> <li>• Sensor cable B2 is defective.</li> </ul>
Measurement	Also see at CB X2.
Error code reset	Perform an MR.

**°C / \* - ERROR 52**

Error cause	Overtemperature in centrifuge chamber.
Error consequence	The centrifuge slows down until the "open the lid" release occurs.
Error remedy	<ul style="list-style-type: none"> <li>• Sensor cable B1 is defective.</li> <li>• Loose contact in plug.</li> <li>• CP is defective.</li> <li>• CB is defective.</li> </ul>
Measurement	Also see at CB-X3 (PIN 1 and PIN 2) and CP-X101 (PIN 4)
Error code reset	Perform an MR.


**°C / \* - ERROR 53**

Error cause	Temperature sensor in centrifuge chamber has a short circuit or a discontinuity.
Error consequence	The centrifuge slows down until the "open the lid" release occurs. Cooling switches off.
Error remedy	<ul style="list-style-type: none"> <li>• Temperature sensor is defective.</li> <li>• Sensor cable B1 is defective.</li> <li>• Loose contact in plug.</li> <li>• CP is defective.</li> <li>• CB is defective.</li> </ul>
Measurement	Also see at CB-X3 (PIN 5 and PIN 4), CP-X101 (PIN 8)
Error code reset	Perform an MR.

**FU / CCI - ERROR 60**

Error cause	The release signal was not correctly transmitted to FC. The evaluation of the release signal only occurs once after MR.
Error consequence	No further user operation is possible.
Error remedy	<ul style="list-style-type: none"> <li>• CC to FC is defective.</li> <li>• CC to CP is defective.</li> <li>• SB is defective.</li> </ul>
Measurement	Also see at CP-X1 (PIN 4) and FC-S501 (PIN 7).

**General Notice for FU / CCI - ERROR 61 to FU / CCI - ERROR 69**

	<table border="0" style="width: 100%;"> <tr> <td style="padding-right: 20px;">Error consequence</td> <td> <ul style="list-style-type: none"> <li>• FC switches independently.</li> <li>• The rotor freewheels, coasting.</li> <li>• No further user operation is possible.</li> <li>• Cooling continues until nominal value is attained</li> </ul> </td> </tr> <tr> <td>Error code reset</td> <td> <ul style="list-style-type: none"> <li>• Mains switch is OFF.</li> <li>• Switch mains switch to ON after 1 min.</li> </ul> </td> </tr> <tr> <td>Measurement</td> <td> <ul style="list-style-type: none"> <li>• Also see at FC-S501 (PIN 4) and CP-X1 (PIN 13).</li> </ul> </td> </tr> </table>	Error consequence	<ul style="list-style-type: none"> <li>• FC switches independently.</li> <li>• The rotor freewheels, coasting.</li> <li>• No further user operation is possible.</li> <li>• Cooling continues until nominal value is attained</li> </ul>	Error code reset	<ul style="list-style-type: none"> <li>• Mains switch is OFF.</li> <li>• Switch mains switch to ON after 1 min.</li> </ul>	Measurement	<ul style="list-style-type: none"> <li>• Also see at FC-S501 (PIN 4) and CP-X1 (PIN 13).</li> </ul>
Error consequence	<ul style="list-style-type: none"> <li>• FC switches independently.</li> <li>• The rotor freewheels, coasting.</li> <li>• No further user operation is possible.</li> <li>• Cooling continues until nominal value is attained</li> </ul>						
Error code reset	<ul style="list-style-type: none"> <li>• Mains switch is OFF.</li> <li>• Switch mains switch to ON after 1 min.</li> </ul>						
Measurement	<ul style="list-style-type: none"> <li>• Also see at FC-S501 (PIN 4) and CP-X1 (PIN 13).</li> </ul>						

**FU / CCI - ERROR 61**

Error cause	Error in computing section.
Error remedy	<ul style="list-style-type: none"> <li>• CC is defective.</li> <li>• FC is defective.</li> </ul>

**FU / CCI - ERROR 62**

Error cause	Undervoltage. Mains voltage less than 20% as nominal voltage.
Error remedy	<ul style="list-style-type: none"> <li>• Supply voltage too low, see chapter "Short the mains choke coil".</li> <li>• CC is defective.</li> <li>• FC is defective.</li> </ul>
Measurement	Also see at FC, U <sub>DC</sub> .

**FU / CCI - ERROR 63**

- Error cause      Overcurrent.
- Error remedy     • Short circuit in motor.  
                          • Motor impedance is too low.  
                          • CC is defective.  
                          • FC is defective.

**FU / CCI - ERROR 64**

- Error cause      Voltage in intermediate circuit:  
                          >410 V DC at 230 V  
                          >205 V DC at 115 V  
                          This error normally only occurs when the drive is being braked.
- Error remedy     • BR is defective.  
                          • CC is defective.  
                          • FC is defective.
- Measurement    Also see at FC, U<sub>DC</sub>.

**FU / CCI - ERROR 67**

- Error cause      Only centrifuges with 115 V.  
                          Overtemperature in the motor. The cable “overtemperature” in  
                          the motor has high impedance.
- Error remedy     • Overtemperature switch opens because of overtemperature  
                          in the motor  
                          • CC is defective.  
                          • FC is defective.  
                          • Motor is defective
- Measurement    Also see at FC, remove plug S2 and measure at the plug  
                          Switch closed:     $\approx 0 \Omega$   
                          opened:             $\infty \Omega$

**FU / CCI - ERROR 68**

- Error cause      Overtemperature in FC.
- Error remedy     • Insufficient heat abduction from FC to centrifuge housing.  
                          There is no, or not enough, heat-conducting paste between  
                          FC and housing.  
                          • Full-load operation and an ambient temperature > 45°C.  
                          • CC is defective.  
                          • FC is defective.

**FU / CCI - ERROR 69**

- Error cause EEPROM in FC is defective.
- Error remedy
- CC is defective.
  - FC is defective

**FU / CCI - ERROR 84**

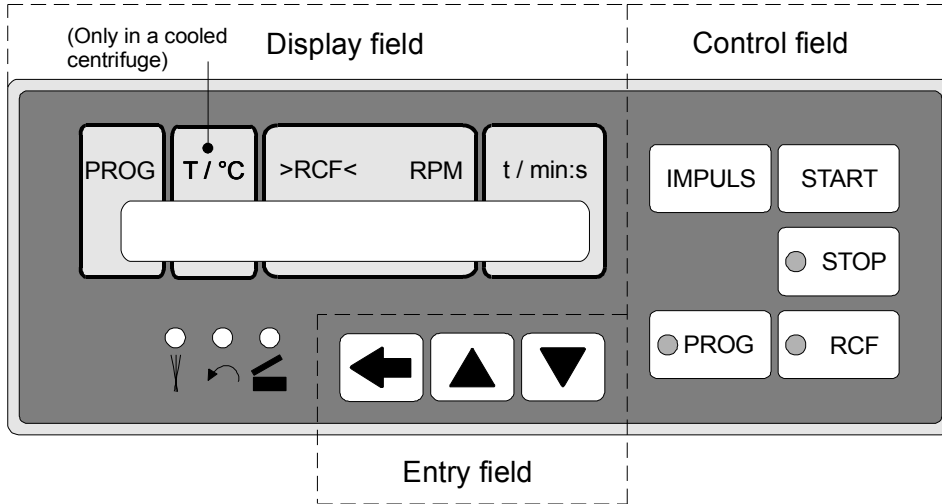
- Error cause FC recognises excess speed.  
During rotation the speedometer pulses (6 per revolution) are controlled by the FC.  
The FC switches the centrifuge off, when the maximum speed of the rotor is exceeded more than 500 rpm.
- Error remedy
- CC is defective.
  - FC is defective.
- Measurement Also see at SB-X4 and FC S501 (PIN 8).
- Error code reset Perform an MR.


**FU / CCI - ERROR 85**

- Error cause "Watchdog" in FC  
Discrepancy in program procedure
- Error remedy
- CC is defective.
  - FC is defective.
- Error code reset Perform an MR.

### 5. Factory setting

#### 5.1. Control panel



 The EPROM of the CP must, in all circumstances, correspond to the machine version and the cooling version.

#### 5.2. Procedure for initialisation

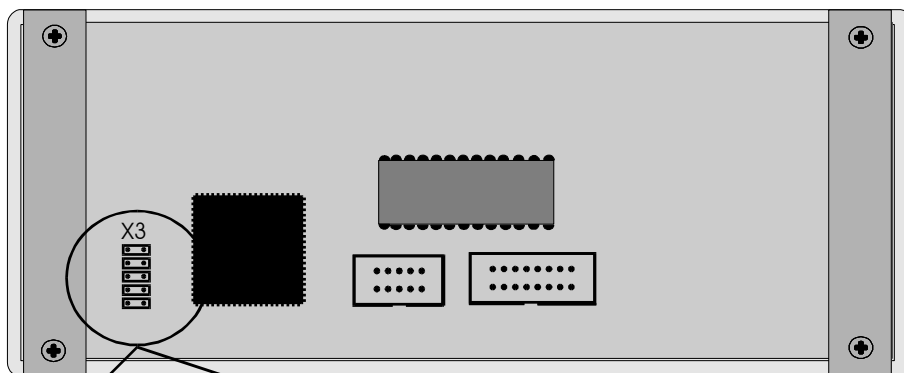
An initialization must be carried out:











- after replacing the FC.

The frequency converter must be adjusted to the centrifuge.

Requirement:

1. Rotor has stopped.
2. LL is open.
3. Mains switch is OFF.
4. Plug on coding strip X3 on the CP each a jumper in slot 3 and 4 (initialization position).



- |   |   |                  |   |   |                       |
|---|---|------------------|---|---|-----------------------|
| 0 |  | Werkseinstellung | 0 |  |                       |
| 1 |  | Factory setting  | 1 |  |                       |
| 2 |  |                  | 2 |  |                       |
| 3 |  |                  | 3 |  | Initialisierungs-Mode |
| 4 |  |                  | 4 |  | Initialization-Mode   |

CP : control panel, FC : frequency converter, SB : supply board, CB : cooling board, CC : control cable, LL : lid locking, BC : braking chopper, BR : brake resistor, MR : mains reset

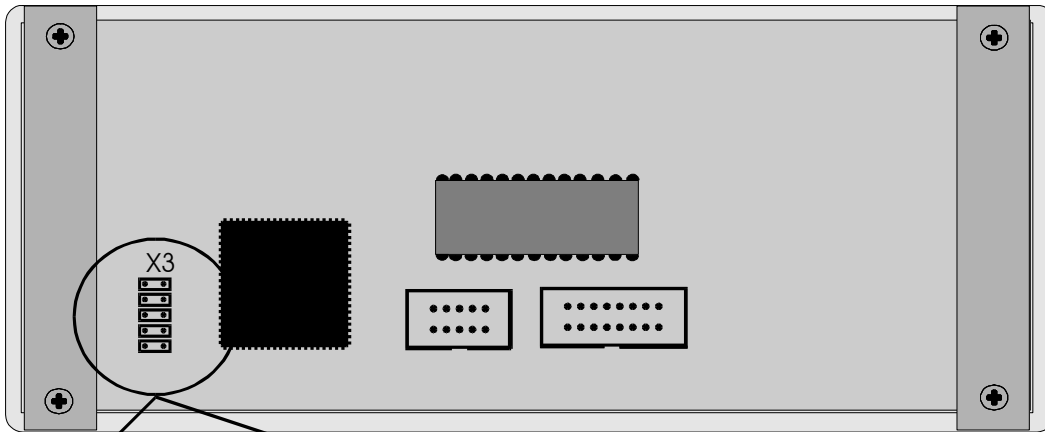


To carry out an offset compensation, measure the temperature directly on the temperature sensor with a temperature measuring device. Then enter the measured value in the display and save it.



Each correction must be confirmed by the **START** key.

- Requirements:
1. Rotor has stopped.
  2. LL is open.
  3. Mains switch is OFF.
  4. Plug on coding strip X3 at the CP the jumper from slot 0 to slot 3 (OFFSET position).



0	<input checked="" type="checkbox"/>	Werkseinstellung	0	<input checked="" type="checkbox"/>	
1	<input type="checkbox"/>	Factory setting	1	<input type="checkbox"/>	
2	<input type="checkbox"/>		2	<input type="checkbox"/>	
3	<input type="checkbox"/>		3	<input checked="" type="checkbox"/>	Offset-Mode
4	<input type="checkbox"/>		4	<input type="checkbox"/>	

### 5.4.1. OFFSET value

The OFFSET value is the difference between the actual temperature and the sensor temperature.

Example:

$$\begin{array}{rclcl}
 \text{Actual temperature} & - & \text{Sensor temperature} & = & \text{OFFSET value} \\
 25.5 \text{ }^\circ\text{C} & - & 27.0 \text{ }^\circ\text{C} & = & -1.5 \text{ }^\circ\text{C}
 \end{array}$$








## 6. Function retrievals / settings

Requirements:

1. Rotor is stopped.
2. Mains switch is ON.

Keep  key pressed down until (after about 8 sec) the following appears in the display:

1. **SOUND / BELL ON1** or **OFF** (acoustic signal)

Press  key. Every time the  key is pressed, the display alters as follows:

2. **CONTROL XXXXX h** Hours of operation
3. **VERS XX °C / \* XX** Machine version, cooling version
4. **FU / CCI - 1000** FC type
5. **FU / CCI - S. 00.XX** FC software

If nothing more is keyed in for 8 sec, the CP switches over to normal mode. Only Nos. 1. and 2. of the function retrievals listed here can be altered.


### 6.1. Acoustic signal

After in the display appears:




- **SOUND / BELL ON1** or **SOUND / BELL OFF**


the acoustic signal can be deactivated or activated after standstill using the   keys.

- ON1** Every 30 sec there is an acoustic acknowledgement that the rotor has stopped. The acknowledgement can be silenced by pressing a key or opening the lid.
- OFF** The fact that the rotor has stopped is not acknowledged acoustically.



The setting of the acoustic signal must be confirmed by pressing the  key. In the event of an error, the acoustic signal sounds every 2 sec. until a key is pressed or the lid is opened.

### 6.2. Hours of operation

After the **CONTROL XXXXX h** appears, the hours of operation can be seen and, after being selected by pressing the  key, can be altered using the   keys.

The  key sets the hours-of-operation indicator to 0.


The  key increases the hours-of-operation display by 1.

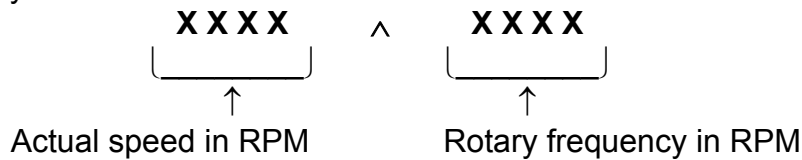
To make the number of hours increase quickly, keep the  key pressed down. The setting of the hours of operation must be confirmed by pressing the  key.


### 6.3. Slippage of the drive

Requirement: The centrifuge is running at its rated speed.

Permissible slippage: < 5% of the rated speed.

Keep the  key pressed down until (after about 8 sec.) the following appears in the display:



When the  key is pressed again, the CP switches to normal mode.

### 6.4. Setting display contrast on control panel

The display contrast has been preset at the factory, but can be readjusted.

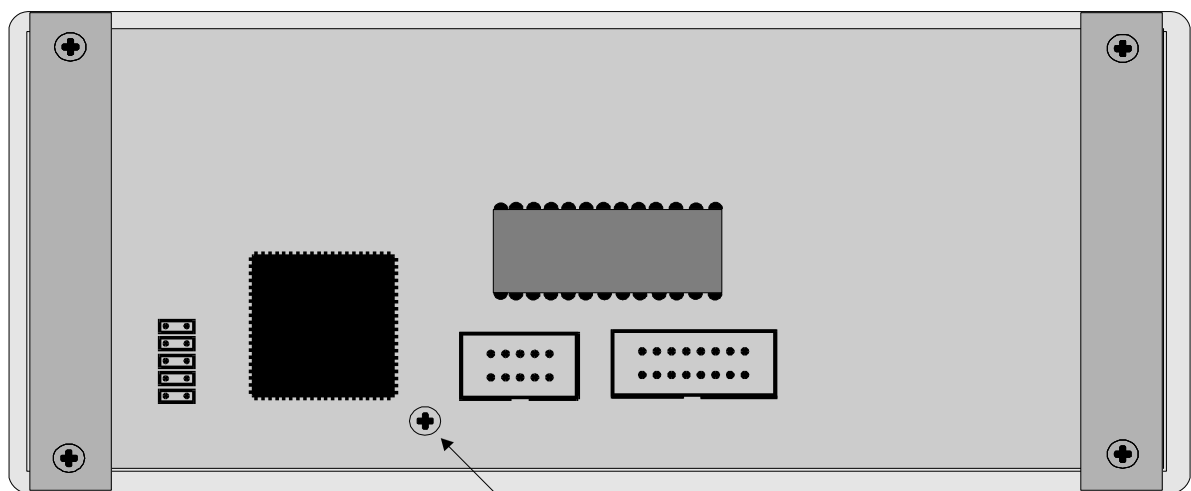
Requirements: The control panel is at room temperature (20 ... 25°C).

The contrast must be adjusted so that the background pixels are not visible.

#### Adjustment:

Using a screwdriver, adjust the contrast on the trimming potentiometer on the rear side of the control section (see diagram).

Rear side of control panel:



Trimmer-Potentiometer für LCD-Kontrast  
trimming potentiometer for LCD-contrast

## 7. Functional check

### 7.1. Functional check at factory




Following accessories are required to perform the functional check:

- Testing rotor
- Two reaction receptacles filled with water

Table 7 lists measured values, and, ranges of measured values, which have been laid down for these accessories.

In the final check, the functional efficiency of each centrifuge is verified, with the measured values and ranges of measured values being taken into account.

**Table 7**

Measurements carried out on the centrifuges at the factory				UNIVERSAL	
				32	32 R
testing rotor				1628	
- with bucket				1621	
- load: two tubes				15 ml	
- tubes filled with				10 ml glycerin	
<b>Measuring instruments used in final check</b>					
Temperature measuring instrument		THERM 2250-1		X	
Moving-iron current measuring instrument				X	
Rated speed	$n_{max}$	RPM		4500	
Slippage	at $n_{max}$	RPM		4500-5000	
<b>Test rotor for current consumption 1615</b>					
Rated current	up to $n_{max}$		A	1,8	2,7
Total current	with cooling		A	---	4,1
Starting time	Stage 9 up to 4500 rpm	sec		30 – 38	
Rundown time	Stage 9 from 4500 rpm	sec		30 – 38	
Starting time	Stage 4 up to RPM 1500	sec		25 – 33	
Rundown time	Stage 4 from RPM 1500	sec		30 – 37	
Imbalance	Run through at	g		≤ 4	≤ 6
	Switch off at	g		≥ 8	≥ 10

Temperature measured at room temperature RT	
Sample temperature after 1 h running time	RT + 20 K
Sample temperature in cooled centrifuges after 1 h running time	
1 <sup>st</sup> run            4°C    4500 RPM	2°C to 6°C
2 <sup>nd</sup> run            20°C   4500 RPM	19°C – 21°C
3 <sup>rd</sup> run            37°C   4500 RPM	35°C– 39°C
Tempertures measured after the 2 <sup>nd</sup> run	
Motor:            Unscrew motor covering and measure at stator lamination bundle	RT + 80 K
A bearing:        Measure ball bearing temperature at inner ring	RT + 80 K
FC:                Measure at FC fastening brackets	RT + 35 K

## 8. Functional test

### 8.1. Checking the proper working order

By measuring and comparing the data listed under Table 7, it can be determined if a centrifuge is in proper working order. A precondition for this is that the necessary components stated under Table 7 are used for the measurements.

If the measurements are carried out using other components, the numerical values from the "Rotor and accessories" chapter of the operating instructions for the particular centrifuge must be employed.

If the measured values obtained for:

- the speed,
- the starting and rundown times
- the temperatures in cooled centrifuges,

are identical to the numerical values in Table 7, or to those in the "Rotor and accessories" section of the operating instructions, then the centrifuge is in proper order.

### 8.2. Proper working order after repairs

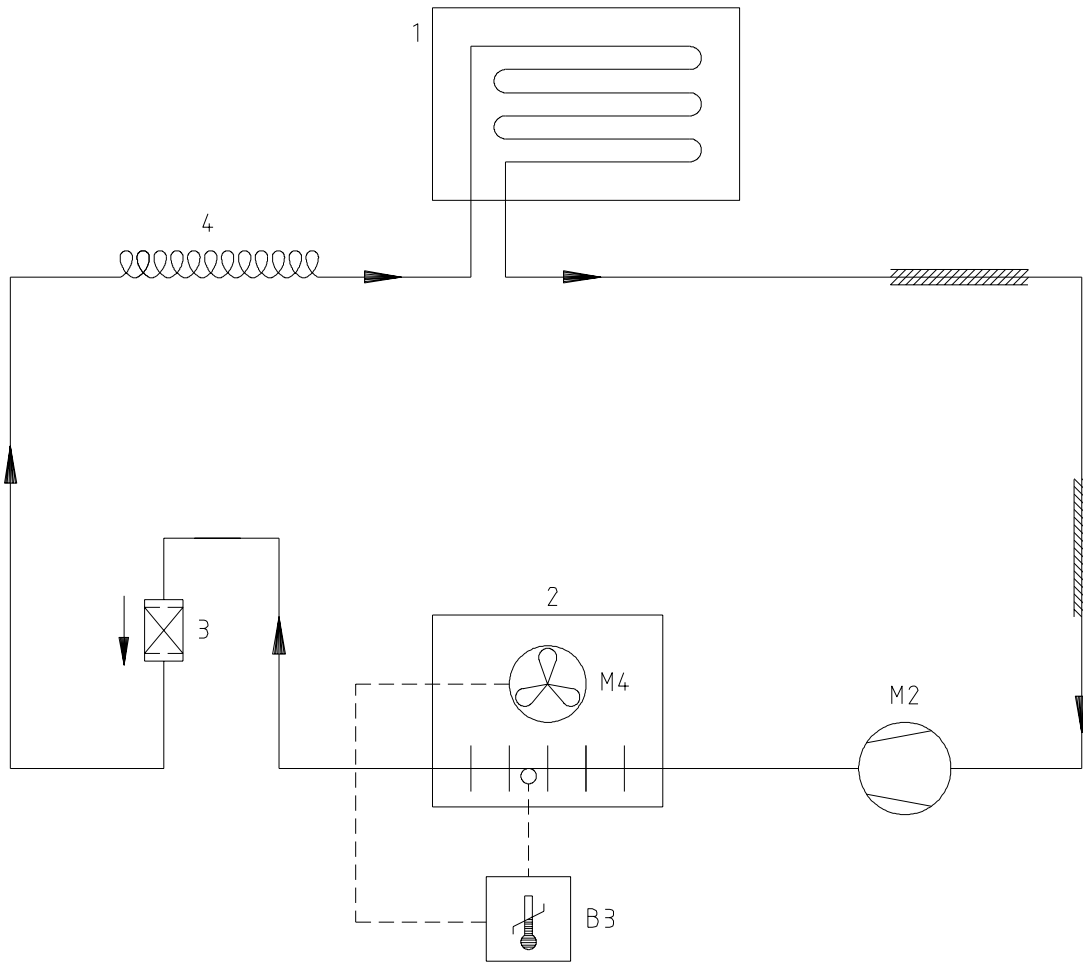
See section headed "Checking the proper working order". The following values must be checked in addition:

- Insulation resistance > 2 M $\Omega$
  - Protective conductor resistance < 0,2  $\Omega$
  - Leakage current < 3,5 mA \*
- \* limit according to EN 61010

A laboratory centrifuge do not belong to those medical appliances which may be tested according to the regulation IEC 601 or corresponding national medical electronic standards. Laboratory centrifuges are classified as laboratory equipment.

The regulations applying to laboratory equipment are IEC 1010 or European standard EN 61010.

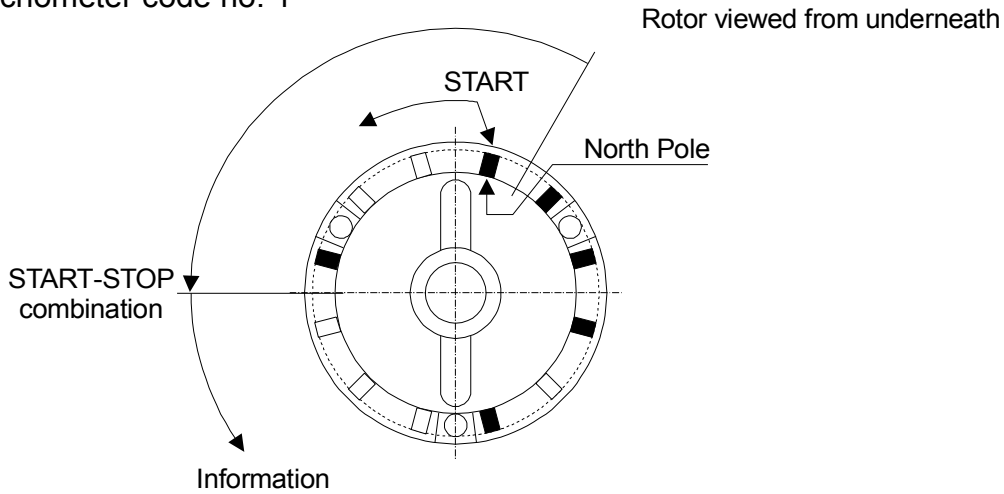
**9. Cooling diagram**



M2	Verdichter (Kompressor)	compressor
M4	Lüfter	fan
B3	Temperaturfühler für Drehzahlsteuerung Lüfter	temp. sensor for speed control fan
1	Verdampfer (Schleuderraum)	evaporator (centrifuge chamber)
2	Verflüssiger (Kondensator)	condenser
3	Trockner	dryer
4	Kapillarrohr	capillary tube

**10. Tacho code configuration UNIVERSAL 32 / 32 R**

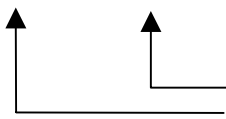
Example: tachometer code no. 1



- tachometer code determines:
1. maximum speed of rotor
  2. run up and braking ramps
  3. control response of electronics

e.g.  
Rotor 1624

1001,0001 0111



rotor code  
Start / Stop combination  
The begin of the Start / Stop combination is marked with a white dot.

Tacho code-no.	configuration	rotor
0	1001 0000 1111	
1	1001 0001 0111	1611, 1619, 1622, 1624, 1626
2	1001 0001 1011	1617 old, 1628
3	1001 0001 1101	1613
4	1001 0001 1110	1618, 1620A
5	1001 0100 0111	1615
6	1001 0101 0101	1614, 1653, 1689
7	1001 0101 0110	1612
8	1001 0101 1010	1645, 1648
9	1001 0110 0011	1650
10	1001 0111 0001	E778-01
11	1001 1000 0111	1399
12	1001 1000 1011	1617 new
13	1001 1000 1101	
14	1001 1000 0011	
15	1001 1100 0011	1620

This tacho code can be measured on plug X4 of the tacho sensor B3 ( see also section "Connecting diagram and component layout supply board (SB)").



## 11. General arrangement of the component

Components	Abbreviation	Plug connection	Connection at boards	Circuit diagram in section	Described in section
Tacho sensor	B3	X4	A1	13.1, 13.3	12.4
Motor / rubber metal bearing	M1	S101	A2	13.7, 13.8	12.5
Frequency converter	A2		A2	13.7, 13.8	12.6
Supply board	A1		A1	13.1, 13.3	12.9
Control board	A4		A3	13.5, 13.6	12.2
EPROM (on CP)			A3		12.3
Control cables	10-conductor	A1-A2		13.1, 13.7	---
	16-conductor	A1-A4		13.1, 13.6	---
only UNIVERSAL 32 R	10-conductor	A3-A4		13.6, 13.10	---
Lid lock	Y1	X5-S1 (X9-S1)	A1	13.1, 13.3	12.15
Brake resistor	R1	P10, P1	A2	13.7, 13.8	12.7
Overtemperature fuse	F3	Y1-X5 (X9-Y1)		13.7, 13.8	12.8
Radio inference suppression filter	Z1	X9-S1 (X10-S1)	A1	13.1, 13.3	12.10
Mains choke coil	L1	-	-	13.8	12.11
Mains switch „ON-OFF“	S1	Z1-X5/Y1 (Z1-		13.1	12.12
Appliance plug	X9	Z1		13.1	12.13
Imbalance switch	S1	X3	A1	13.1, 13.3	12.14
Temperature sensor chamber (only UNIVERSAL 32 R)	B1	X6	A1	13.1, 13.3	12.17
Temperature sensor condenser (only UNIVERSAL 32 R)	B2	X7	A1	13.1, 13.3	12.18
Cooling board (only UNIVERSAL 32 R)	A3		A1	13.9, 13.10	12.16

## 12. Assembling and disassembling components

Before assembling and disassembling components the following steps must be executed:

- Open the lid
- Remove the rotor
- Disconnect the centrifuge from mains

### 12.1. Front panel

- Remove the three fastening screws at the lower edge of the front panel and lift the front panel up.
- Unplug all cable from the back side of the control panel.

### 12.2. Control board (CP) A4

- Remove the front panel (see section 12.1 )
- Remove the two fastening bows
- Press the four fasting clips and press-out the control board.
- exchange the control panel

### 12.3. EPROM at Control board

- Remove the front panel ( see section 12.1 )
- Pull the EPROM carefully out of IC-socket.
- Pay attention to the polarity of the EPROM when installing.
- Do not bend the IC-pins.



Before touching the EPROM ensure that your own static electricity is discharged.

- Replace the EPROM.

### 12.4. Speed sensor B3 (speedometer)

- Remove the to fastening screws of the motor hood
- Unscrew speed sensor (speedometer) from upper end plate of motor.
- Remove the front panel ( see section 12.1 ).
- Unplug plug number X4 from Supply board A1.
- Remove the cable fixtures at the motor
- Replace speed sensor (speedometer).

### **12.5. Motor M1**

- Unscrew speed sensor (speedometer) from upper end plate of motor, and place it in centrifuge chamber.
- Pull out the 3 cables from plug S101 at the FC (BU/BN/BK).
- Use a socket spanner to loosen and remove the three fastening nuts on lower end plate of motor.
- Lift motor upwards out of centrifuge. Unplug the earth lead.
- Before motor is installed, the three vibration dampers must be checked for possible wear or cracks, and if necessary replaced.
- Replace the motor.
- Care must be taken of the anti-twist device when the vibration dampers are being installed.

### **12.6. Frequency converter (FC) A2**

- Detach the front panel (see section 12.1 )
- Pull all plugs out of FC.
- Unscrew from below the four fastening screws of FC.
- Unscrew the screws on the connecting clips and pull the cables out.
- Replace FC
- Before installation, it must be noted that there is a heat-conducting paste between FC and centrifuge housing floor.



Heat conducting from FC to centrifuge housing floor must be ensured.

### **12.7. Brake resistor (BR) R1**

- Loosen the two fastening screws of the BR.
- Unplug the cables at the BR and the FC.
- Replace BR.

### **12.8. Overtemperature fuse F3**

- Unplug the two cable of overtemperature switch.
- Remove the two fastening screws
- Replace BR.

### **12.9. Supply board (SB) A1**

- All plugs on the SB must be pulled out.
- Unscrew the four screws, and take SB out of centrifuge.
- Replace SB

### **12.10. Radio interference suppression filter Z1**

- Detach the front panel (see section 12.1 )
- Unscrew the two fastening screws of the radio interference suppression filter.
- Remove the plugs from the radio interference suppression filter.
- Replace the radio interference suppression filter.

## 12.11. Mains choke coil L1

### 12.11.1. Assembly and disassembly

- Pull both plugs from the mains choke coil.
- Undo the fastening screws of the mains choke coil.
- Replace the mains choke coil.

### 12.11.2. Short the mains choke coil



In countries, in which the European standard EN 61000-3-2 applies it is not allowed to short the mains choke coil.

The mains choke coil reduces the mains input current below the limit values stated in the above mentioned European standard.

If the centrifuge is run with undervoltage, that is mains frequency 50 Hz with a voltage < 205 V or mains frequency 60 Hz with a voltage < 210 V the voltage drop of the mains choke coil can cause the error FU / CCI - ERROR 62.

The short of the mains choke coil will increase the supply voltage of the frequency converter.

- Pull both plugs (A) from the mains choke coil, see Figure 1.
- Cut off both plugs and connect the ends of both cables together with a luster terminal (B), see Figure 2.

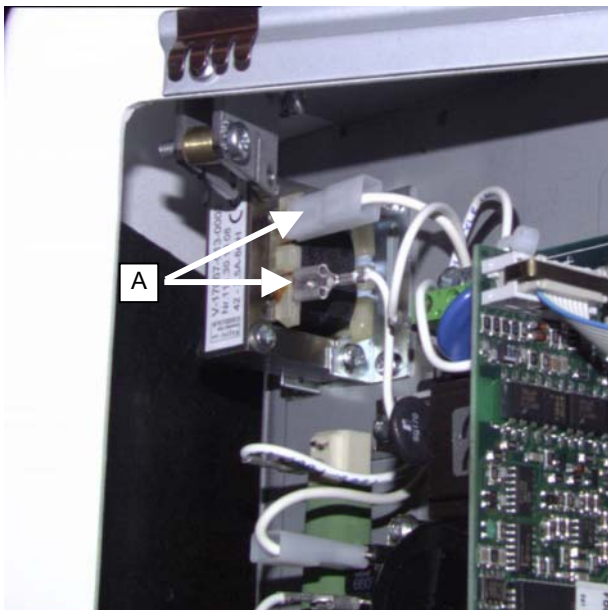


Figure 1

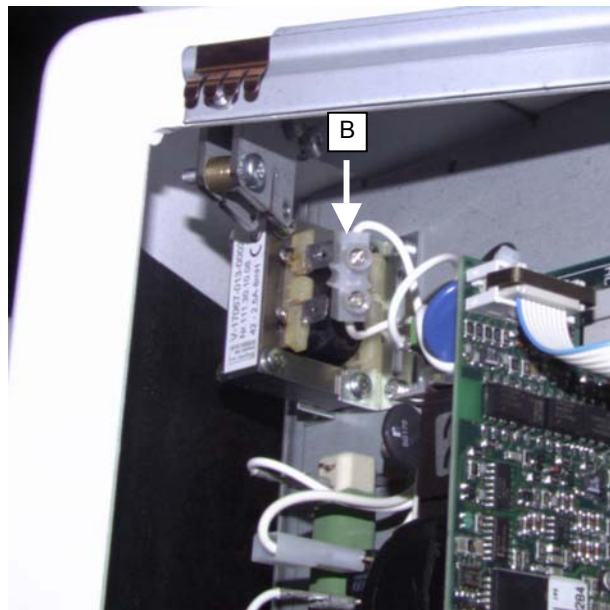


Figure 2

## 12.12. Mains switch (with overcurrent circuit breaker) Q1

- Remove the radio interference suppression filter (see section 12.10 ).
- Remove all plugs at mains switch.
- Press mains switch out of lower part of housing

**12.13. Appliance plug , overvoltage protection F1**

- Remove mains switch (see section 12.12 ).
- Unscrew the two fastening screws at the appliance plug.
- Pull the appliance plug out of the opening.
- Remove the overvoltage protection from the appliance plug.
- Replace appliance plug.
- Unplug the cables at the overvoltage protection.
- Replace overvoltage protection.

**12.14. Imbalance switch S1**

- Remove plug from position X3 at the CB.
- From below loosen the two fastening screws of the imbalance switch.
- Loosen the fastening nuts from the motor. Lift up the motor and pick up the imbalance switch through the opening at the centrifuge chamber.
- Replace imbalance switch.

**12.15. Lid lock**

- Remove the front panel.
- Unplug all cable from the lid lock.
- Loosen the to fastening screws on the to of the housing.
- Exchange the lid lock.

**12.16. Cooling board (CB) A3 (only UNIVERSAL 32 R)**

- Remove the front panel.
- All plugs on the CB must be pulled out.
- Unplug the two cables (RD and BK) at the SB.
- Unscrew the four fastening screws at the CB.
- Replace the CB.

**12.17. Temperature sensor B1 in centrifuge chamber (only UNIVERSAL 32 R)**

- Remove plug from position X3 at the CB.
- Remove the four bushes in the plug (unlock the bushes with appropriate tools at the front of the plug). Then press out the four bushes.
- Press out the temperature sensor in the centrifuge chamber.
- Replace temperature sensor.

**12.18. Temperature sensor B2 at condenser (only UNIVERSAL 32 R)**

- Remove plug number X2 at the CB.
- Unscrew the temperature sensor (one screw).
- Replace temperature sensor.

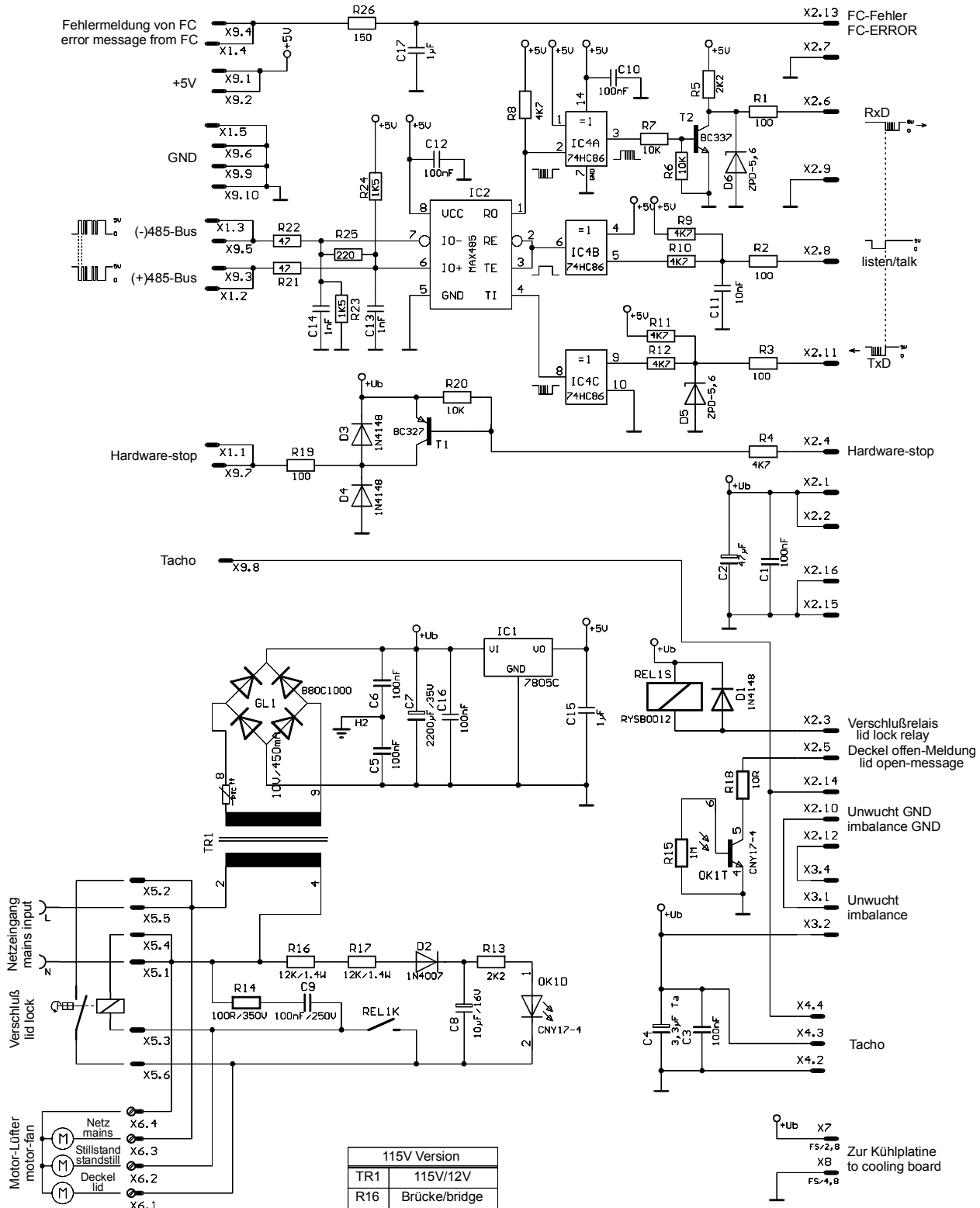
13. Circuit diagrams

Used cable colours and their short codes:

Colour	Short code
black	BK
brown	BN
red	RD
orange	OG
yellow	YE
blue	BU
violet	VT
green	GN
grey	GY
white	WH
pink	PK
gold	GD
turquoise	TQ
silver	SR
green-yellow	GN/YE

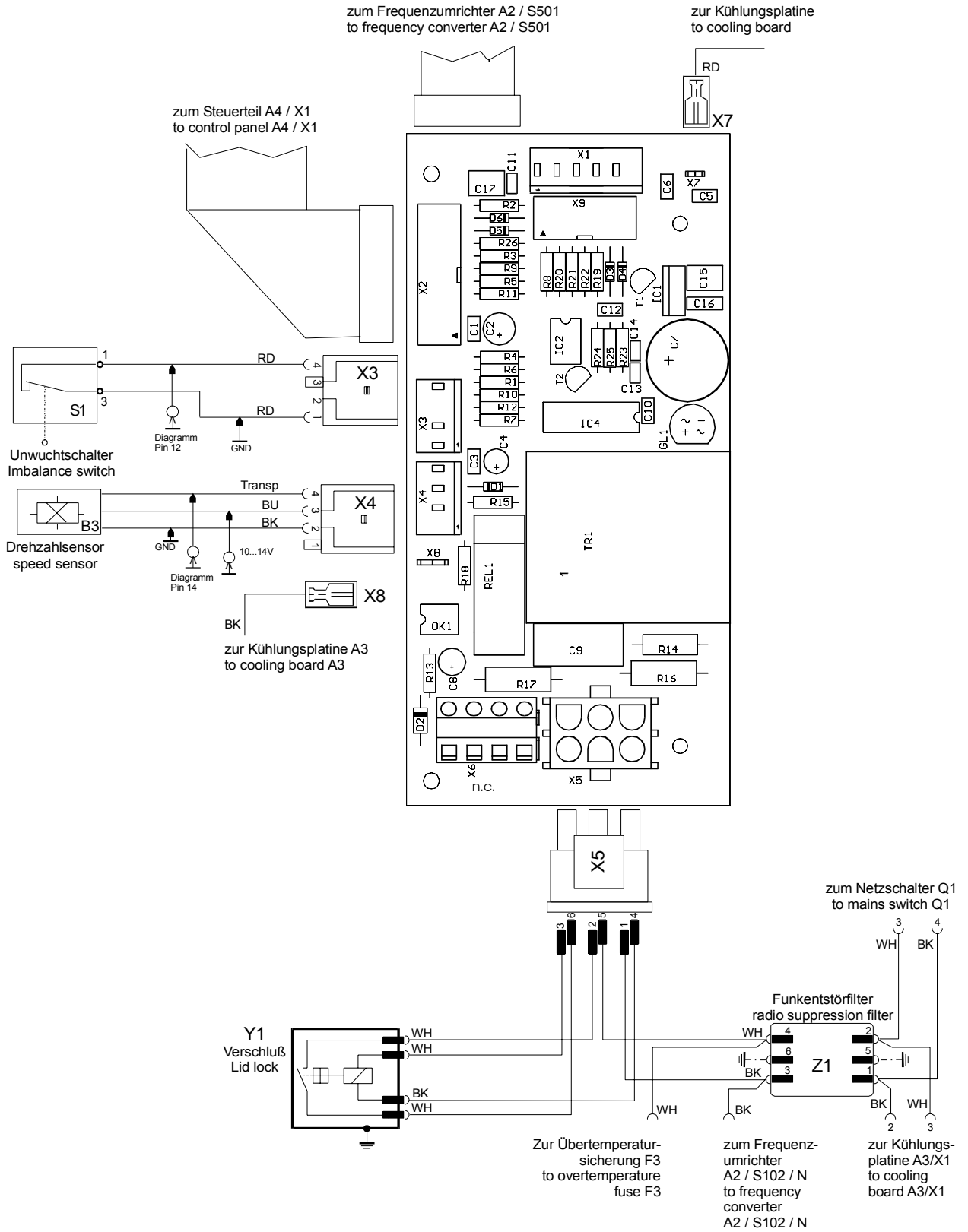


### 13.2. Circuit diagram supply board (SB)



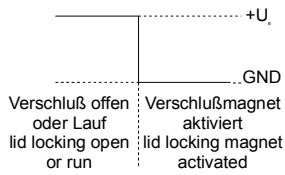


### 13.3. Connecting diagram and component layout supply board (SB)

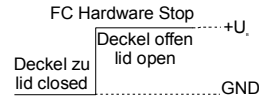


### 13.4. Signals in control cable between CP and SB

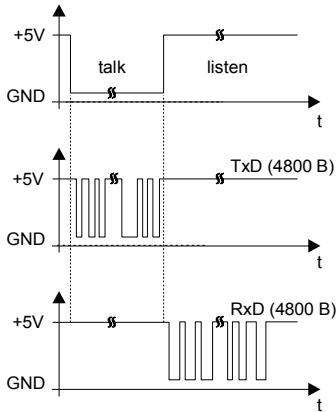
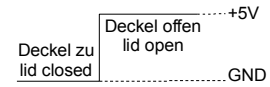
X1 Pin 3 ⇒ GND



X1 Pin 4 ⇒ GND



X1 Pin 5 ⇒ GND



X1 Pin 8 ⇒ GND

ser. Schnittstelle vom CP  
ser. interface from CP

X1 Pin 11 ⇒ GND

ser. Schnittstelle vom CP  
ser. interface from CP

X1 Pin 6 ⇒ GND

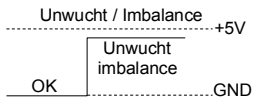
ser. Schnittstelle zum CP  
ser. interface to CP

X1 Pin 7 ⇒ GND : 0V

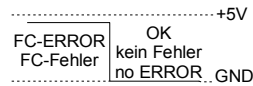
X1 Pin 9 ⇒ GND : 0V

X1 Pin 10 ⇒ GND : 0V

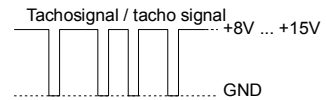
X1 Pin 12 ⇒ GND



X1 Pin 13 ⇒ GND



X1 Pin 14 ⇒ GND



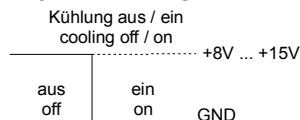
6 Impulse pro Umdrehung  
siehe Tachocode  
6 pulses per revolution  
see tachocode

nur bei Zentrifuge mit Kühlung  
only centrifuge with cooling

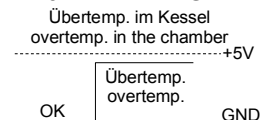
X101 Pin 8 ⇒ GND

Spannung vom Temperaturfühler  
voltage from temperature sensor  
25°C = 2.98V  
Unterschied / difference 1°K = 10mV

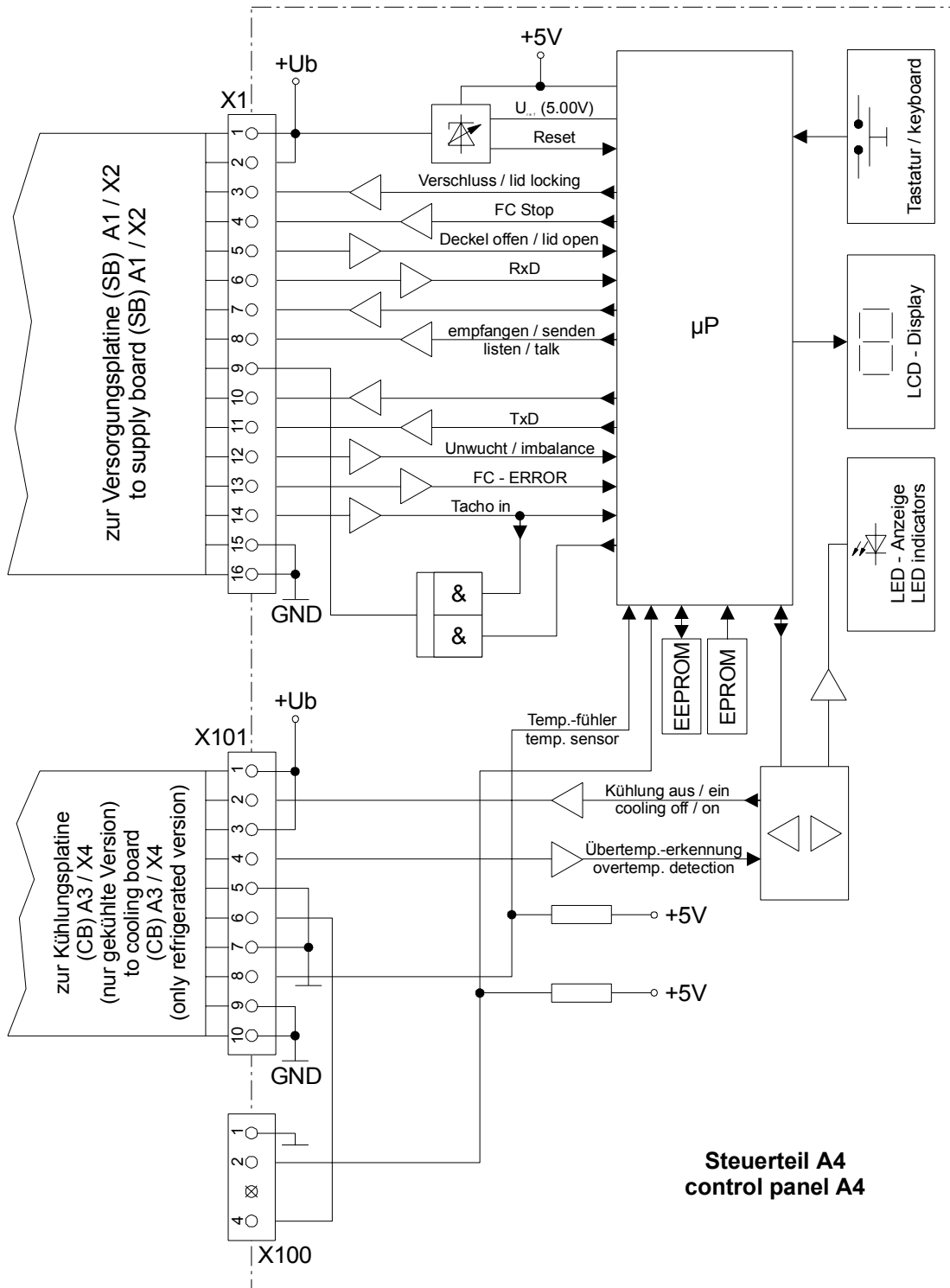
X101 Pin 2 ⇒ GND



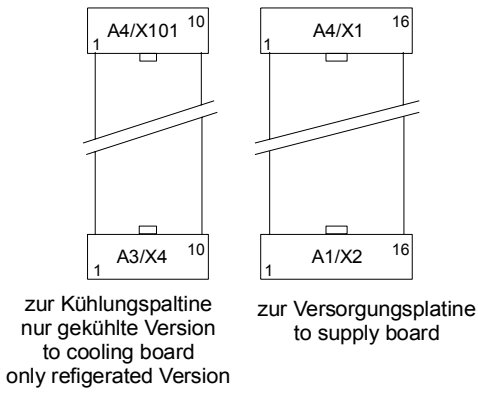
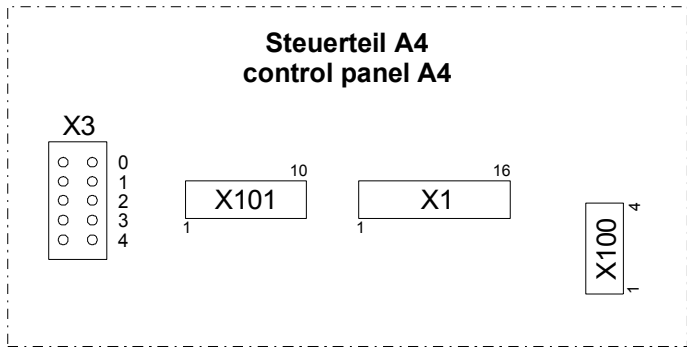
X101 Pin 4 ⇒ GND



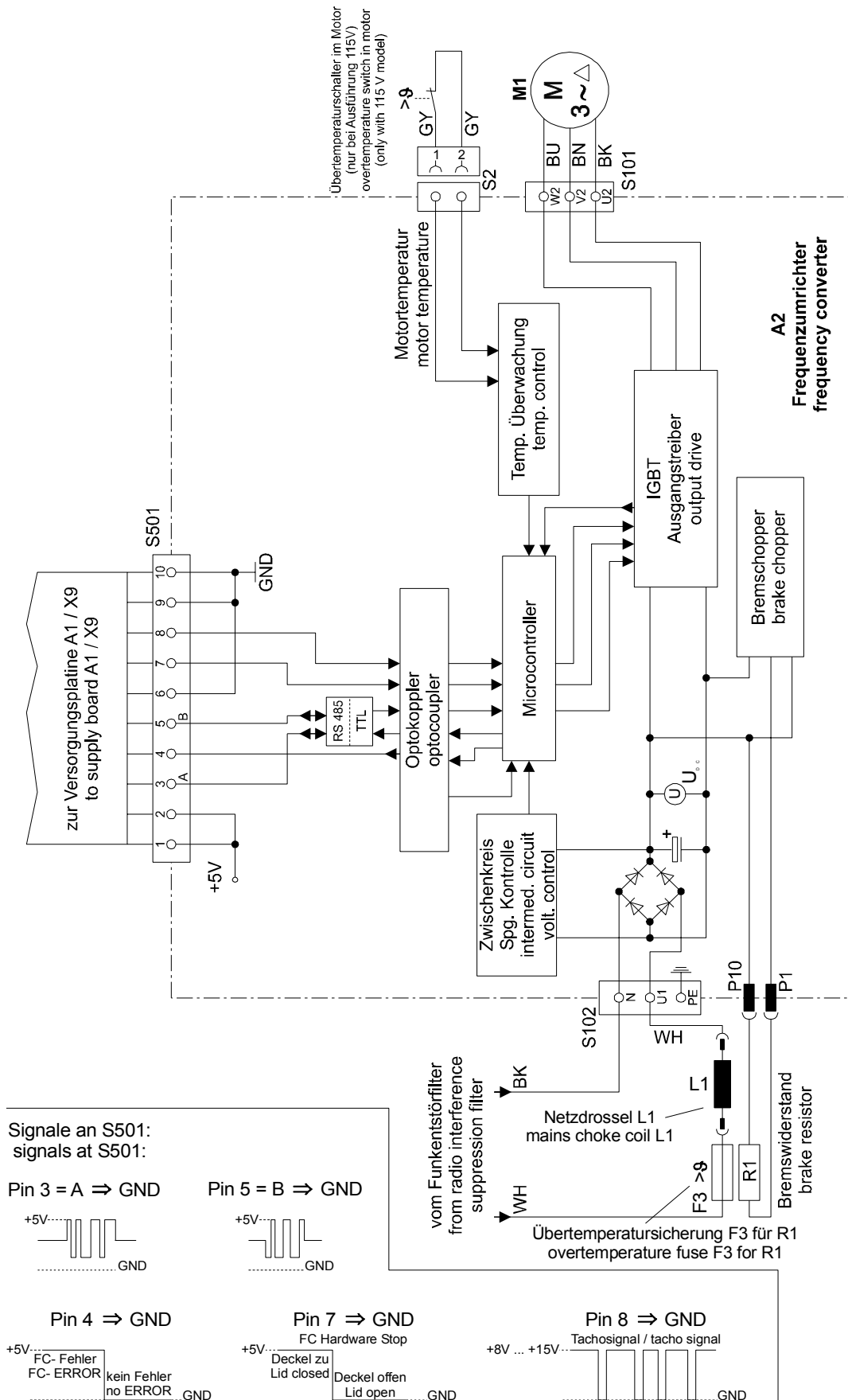
### 13.5. Blockdiagram Control board (CP)



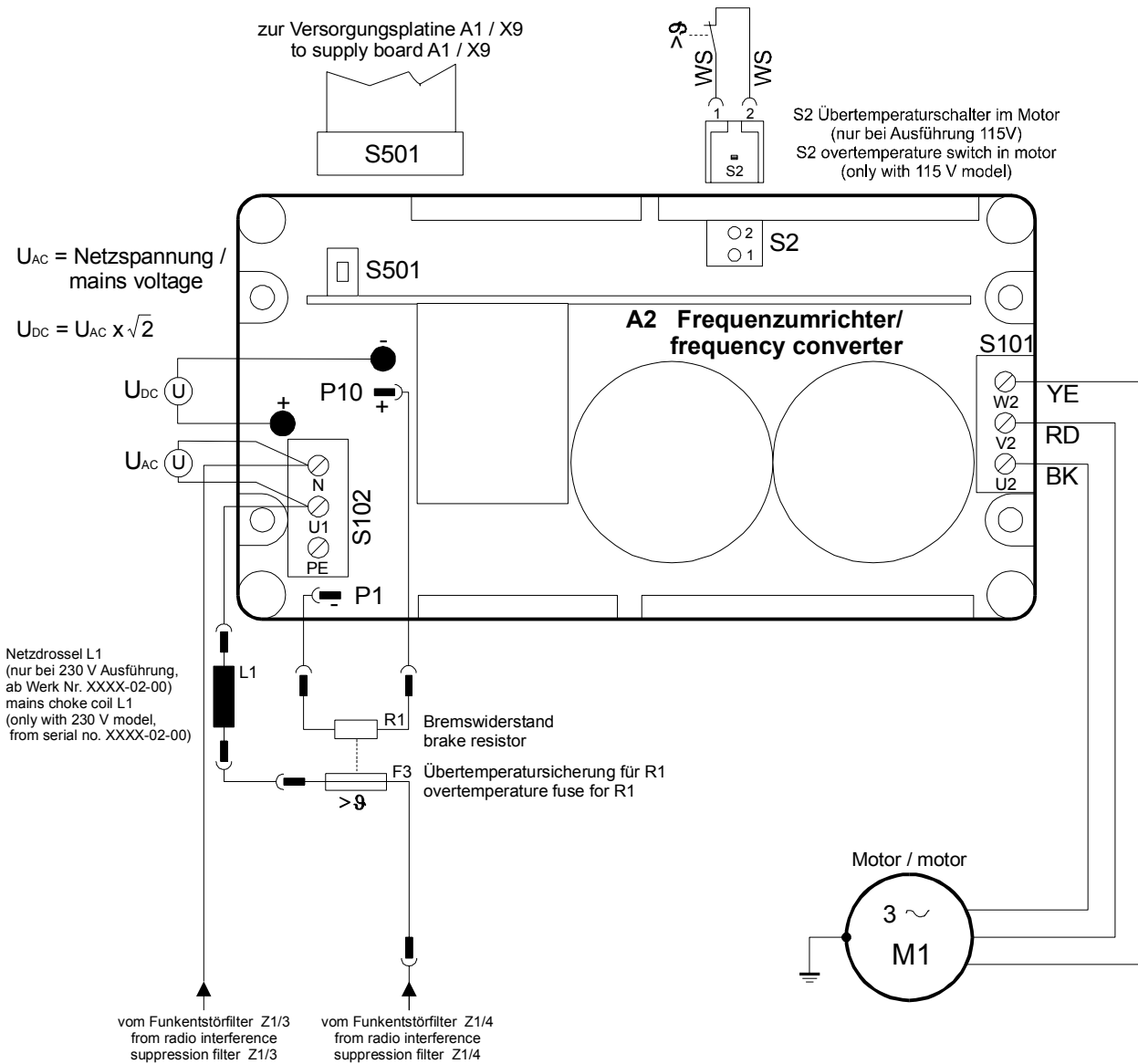
13.6. Connecting diagram Control board (CP)



### 13.7. Blockdiagram Frequency converter (FC) and signals in control cable between FC and SB



### 13.8. Connecting diagram frequency converter (FC)

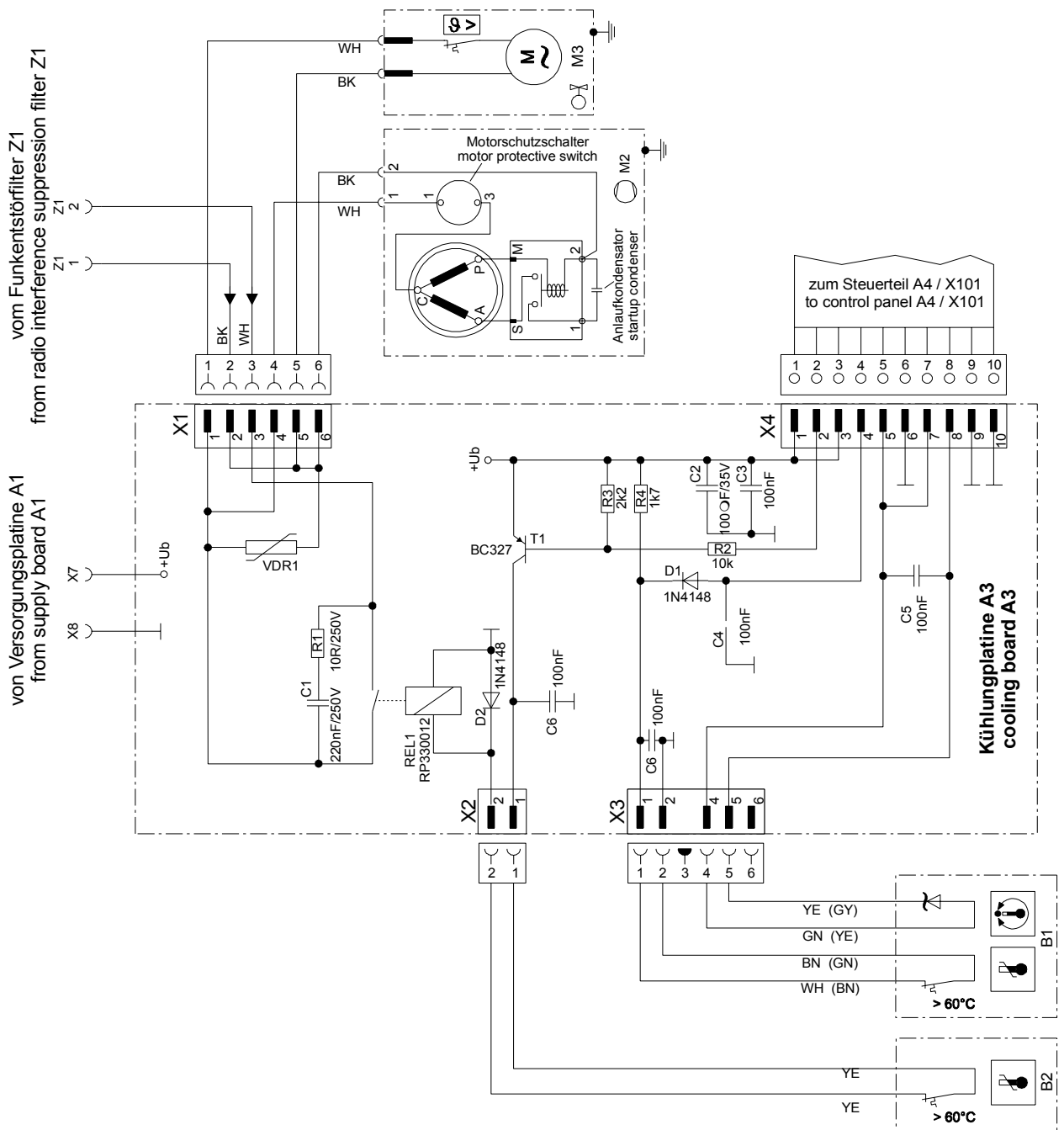


Bremswiderstand	230 V Ausführung:	330 $\Omega$
Brake resistor	115 V Version:	82 $\Omega$

Motorwiderstand (kalter Motor, zwischen je 2 Leitungen)  
Motor resistance value (cold motor, between 2 wires)

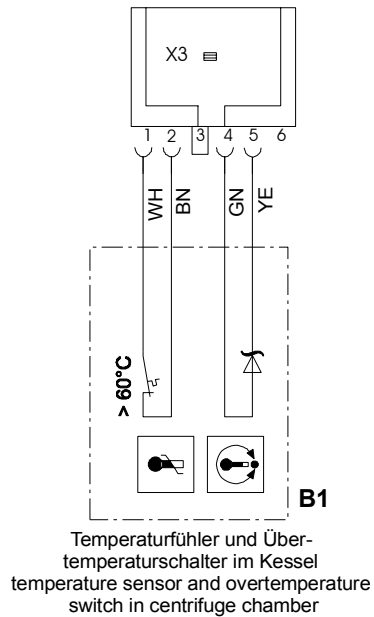
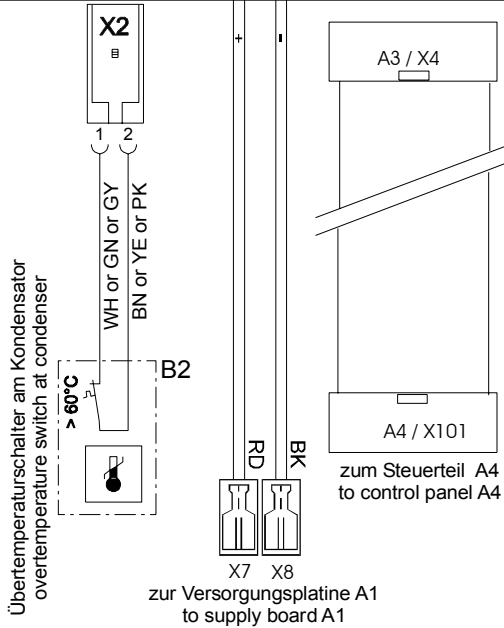
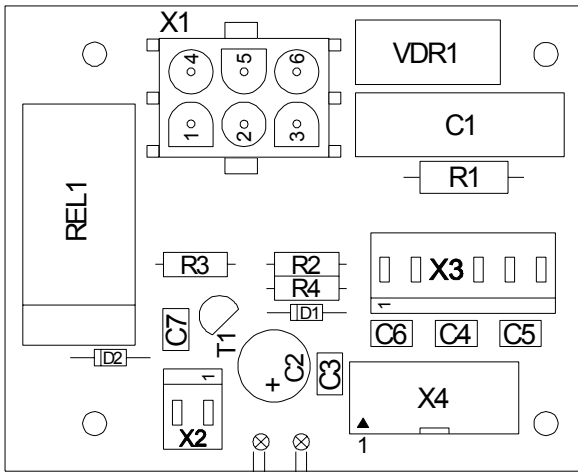
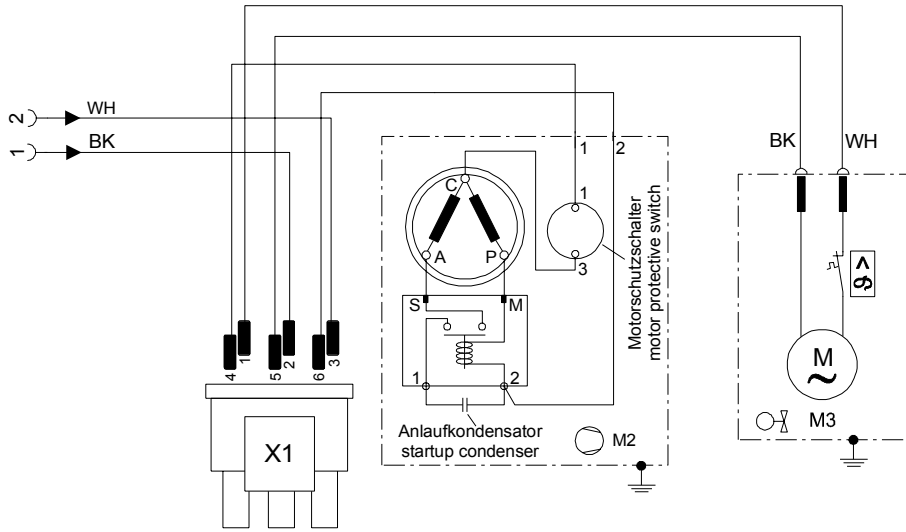
230 V Ausführung:	6,2 $\Omega$
115 V Version:	

### 13.9. Block diagram Cooling board(CB) only UNIVERSAL 32 R



### 13.10. Connecting diagram and component layout cooling board (CB)

vom Funkentstörfilter Z1  
from radio interference suppression filter Z1





#### 14. Technical specifications

Manufacturer	Hettich Zentrifugen D-78532 Tuttlingen			
Model	UNIVERSAL 32		UNIVERSAL 32 R	
Product no.	1605	1605-01	1610 1610-20	1610-01
Mains voltage ( $\pm 10\%$ )	220-240 V 1~	110-127 V 1~	230-240 V 1~	110-127 V 1~
Mains frequency	50 - 60 Hz	50 - 60 Hz	50 - 60 Hz	60 Hz
Connected load	400 VA	450 VA	950 VA	1000 VA
Current consumption	1.8 A	3.3 A	4.0 A	9.0 A
Power consumption	260 W	240 W	700 W	800 W
Refrigerant	-----		R 404A	
Max. capacity	4 x 100 ml			
Max. density	1.2 kg/dm <sup>3</sup>			
Speed           RPM	18000			
Force           RCF	23907			
Kinetic energy	6500 Nm		8500 Nm	
Obligatory inspection	no			
Environment	5°C up to 40°C			
– Ambient temperature	max. 80% up to 31°C,			
– Relative humidity	descending in a linear pattern down to 50% at 40°C			
Sample overtemp.	$\leq 15$ K		-----	
Class of protection	I			
EMC	ISM (Industrial Science Medicine)			
– Emission (Radio interference suppression)	EN 55011 Class B	FCC Class B	EN 55011 Class B	FCC Class B
– Immunity	according to EN 50082-2			
Noise level (dependent on rotor)	$\leq 66$ dB(A)		$\leq 66$ dB(A)	
Dimensions				
• Width	420 mm		420 mm	
• Depth	490 mm		660 mm	
• Height	300 mm		300 mm	
Weight approx.	24,5 kg		46,2 kg	